

AGRICULTURAL Research

JANUARY • 1958

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Beginning

ARS has set in operation two of the new pioneering research laboratories to explore the scientific unknown beyond present limits of knowledge (AGR. RES., August 1957, p. 2).

They are the Pioneering Laboratory for Mineral Nutrition and the Pioneering Laboratory for Plant Physiology, both at USDA's Agricultural Research Center, Beltsville, Md.

Charters have been approved for three other laboratories, to investigate blood antigen, insect pathology, and insect physiology. Other pioneering groups are being planned.

"Highest commendation" for their establishment has come from the Agricultural Research Institute, affiliated with the Agricultural Board of the National Academy of Sciences—National Research Council. The institute described this action as "the single most significant step in decades" to "promote the welfare of the fundamental elements of agricultural science." The Institute saw here "a step which will attract the highest caliber of scientist and particularly will stimulate interest among students in our colleges and universities anxious to pursue pure science as a career."

Applied research depends fundamentally on new scientific discoveries. The new laboratories will help meet our critical need for basic research—research concerned not with immediate problems but with broadening and deepening man's understanding of the physical world and of life processes.

This undirected research calls for outstanding scientists. Such men are S. B. Hendricks, of the Mineral Nutrition group, and H. A. Borthwick, of the Plant Physiology group. Hendricks, a member of the National Academy of Sciences, is widely known for his contributions to soil science and mineralogy, plant physiology, and chemistry. Borthwick is codiscoverer with Hendricks of the fact that light-sensitive pigments control flowering, seed germination, and other behavior of many plants that exhibit the phenomenon known as photoperiodism. He is internationally recognized in this field.

The pioneering laboratories, by encouraging freer play of genius in basic studies, should provide new knowledge we need to solve today's and tomorrow's agricultural problems.

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United States Department of Agriculture

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TRENDS FOR 1958

Economists see output high, prices and net income about the same, production outlays up, number of farms down

■ THE YEAR 1958 may find farmers turning out as much or more than last year's record-breaking output—with average prices about the same.

So say USDA economists of ARS and Agricultural Marketing Service. They base their judgments on 3 assumptions: (1) that business will continue strong with no substantial letdown in production, prices, or employment; (2) that there will not be another burst of inflation; (3) that no major changes will occur in Government plans affecting farm income.

Net income from farming will be about the same since possible increases in production costs may largely offset a rise in gross farm income. According to present indications, farm-cost increases will probably be smaller than in 1957. The bulk of expenses in farm production are now for factory-produced items.

Use of resources is shifting

Changes in resource use are continuing, thereby increasing production outlays. Fertilizer input, for example, has increased three and a half times since 1940. Tractors have tripled. Cost of farm machinery has risen only half as much as farm wage rates. The cost changes vary widely by type of farm. Cost of additional production on a going farm continues much lower than average costs.

Income from nonfarm sources is expected to increase, and the number

of persons on farms is expected to continue to decrease. This could mean a slight gain in per capita income of farmers. Off-farm incomes account for one-fourth the total farm-family income on farms with sales over \$2500. On farms with sales under \$2500, three-fourths of the total income is from off-farm sources. The continued decline in number of farms (about 2 percent) is expected to center in low-production farms.

Marketing charges may rise

Retail food prices may rise further because of increases in marketing charges. Average hourly earnings of workers in marketing firms increased in 1957. Costs of containers, packaging materials, coal and fuel oil, trucks, and machinery bought by these concerns also were higher.

The parity index (price paid by farmers) is likely to creep up, resulting in another slight drop in parity ratio (index of prices received, divided by index of prices paid).

Exports of agricultural products will continue high, but they will probably be less than in the fiscal year that ended June 30, 1957. Stocks of wheat and cotton may be reduced again, but the carryover of feed grains will continue to increase.

Payments for price support, soil bank, and export plans will continue to be large. Acreage-reserve payments of the soil bank will decrease,

but payments under the conservation-reserve part should increase.

Farm debts will probably continue to rise, but value of farm assets will increase, too. Land values will probably go up still more, in spite of low farm incomes. Farm levels of living will increase, owing in part to increased income from nonfarm sources. Our food consumption and diets will remain relatively high.

Commodity outlook reviewed

Cattle prices may average as high or higher in 1958 as in 1957. Hog prices will likely be near 1957 levels during the first part of the year and lower during the second half, since production is expected to be higher than in 1957. Sheep and lamb prices may be about the same.

Milk production is expected to increase slightly and cash receipts from dairy products may rise to a new high. Farmers' egg prices may be higher than the 1957 estimated average of 35 cents a dozen, since production will probably reflect the reduction in the number of layers.

Prices of broilers may be close to the estimated 1957 average of 19 cents a pound, although production is expected to increase slightly.

Feed-grain prices of corn, barley, and sorghum are expected to average lower than a year earlier. This is suggested by the record 1957 production indicated in October and lower price supports than in 1956.

Another large wheat crop may be produced—based on prospective acreage for 1958 and the excellent moisture conditions for winter wheat.

To keep production in balance with market demand at remunerative prices is one of the most serious matters facing American agriculture. Sooner or later, economists say, farms will have to reduce the output of feed grains—or feed more to animals, increasing the output of meat, poultry, and dairy products. ☆

X-RAYS HELP TELL ON **DWARFISM**

Spinal abnormality in a young calf is thus far our best sign of a dwarf-gene carrier, cooperative research shows. Other techniques are under study. Positive identification may eventually rest on combination of several methods.

■ A CLEAR UNDERSTANDING of cattle dwarfism—one of the most misunderstood and feared problems of the industry—is shaping up with increased research by USDA, State experiment stations, and breeders.

There are several different types of dwarfs. The type known as the snorter—so called because it breathes heavily—is probably most common and troublesome. These animals, also known as shorthaired or brachycephalic dwarfs, are thick, potbellied, and shortlegged, with bulging foreheads, undershot lower jaws, and protruding tongues. Such dwarfs can usually be recognized at birth or within 3 or 4 weeks.

Carriers of the dwarf gene, however, aren't easy to identify since they look normal. Most current research is aimed at finding a simple, accurate method of getting rid of dwarfism by identifying these carriers at a young age. This eliminates expensive and time-consuming breeding tests later. Early detection also helps decide which animals should go into the feedlot and which should be saved for breeding.

X-raying of calves' vertebrae appears most promising

Research so far points to the X-ray method as the most promising of several physical and chemical methods under study. The lumbar (loin) vertebrae of many carriers' spines show characteristic abnormalities recognizable in X-rays of calves less than 10 days old. Pictures must be taken when animals are young because it's difficult to get clear X-rays of older animals. Also, the telltale spinal defects that help identify carriers tend to disappear as animals grow older.

Research on the X-ray technique was started at the Iowa Agricultural Experiment Station in cooperation with USDA. Most active work on this method is now underway at Iowa and, jointly with USDA, at the



CONTRAST between dwarfs and normal animal of same age is shown in top photo. Two Angus-Hereford crossbreds at right are dwarfs; animal at left is a normal Hereford. All three are about a year old. Typical snorter-type Hereford dwarf—about 3 months old—is seen in lower photo. Undershot jaw, protruding tongue, short head and legs, potbelly, bulging forehead, thickset look—all help stamp this animal as a snorter dwarf.

SPINAL X-RAY of dwarf calf shows tiny undulations like jagged sawtooth edges on lower vertebrae surfaces. These edges are probably caused by squeezing of vertebrae during cartilagenous development stage; there's an overall shortening of vertebrae and corresponding increase in depth. Milder abnormalities are found in high percentage of carriers' vertebrae. Spine of normal animals is smooth, regular; lower surfaces of vertebrae are shaped like half moon.

Cleared vertebrae sections in insets show these differences even more clearly.

Nebraska, Oklahoma, and Tennessee stations. Eight other stations are cooperating on this and other techniques. Studies are supported by special Federal appropriations, private industry, and individuals.

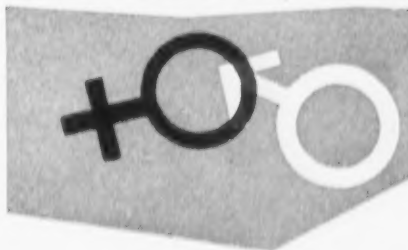
Cooperating stations pool results of their research

X-ray test results were recently pooled by cooperators. Of 186 known carriers, 167 or 90 percent were found to have abnormal vertebrae. Of several thousand calves thought to be dwarf-gene free, 80 percent were found to have normal vertebrae. Abnormal vertebrae in the other 20 percent varied with the line of breeding. So far, it has been impossible to distinguish between the mild abnormalities unrelated to dwarfism and some of those thought to be due to the dwarf gene.

TURN PAGE

Genetics of

DWARFISM



Dwarfism in beef cattle is inherited. It's found in all breeds, and all breeds have one or more types—most of them recessive in inheritance. Some breeds may be free or almost free of the snorter-dwarf gene, but it's hard to get accurate information on this. Snorter dwarfs seem to have increased recently. This may be because animals carrying the dwarf gene have physical characteristics breeders like and select for.

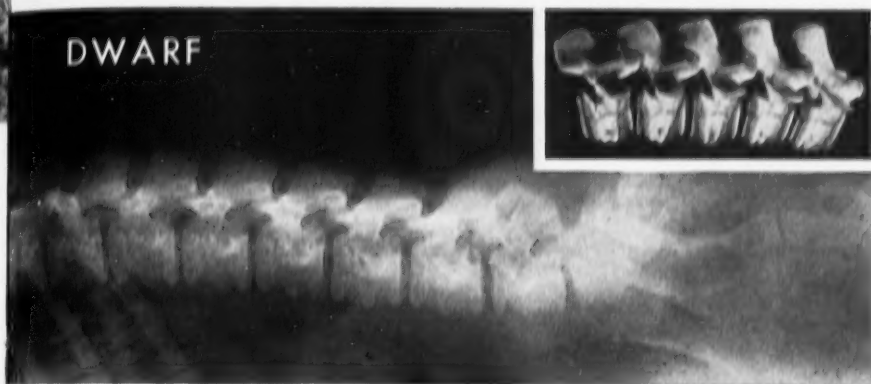
Many researchers believe different genes are responsible for other types of dwarfism. But it's not definitely known if this is so or whether they are merely modifications of the same type.

Dwarfs are produced only if both parents are carriers. Chance may operate to make percentage of dwarfs high or low in a given year, especially in small herds.

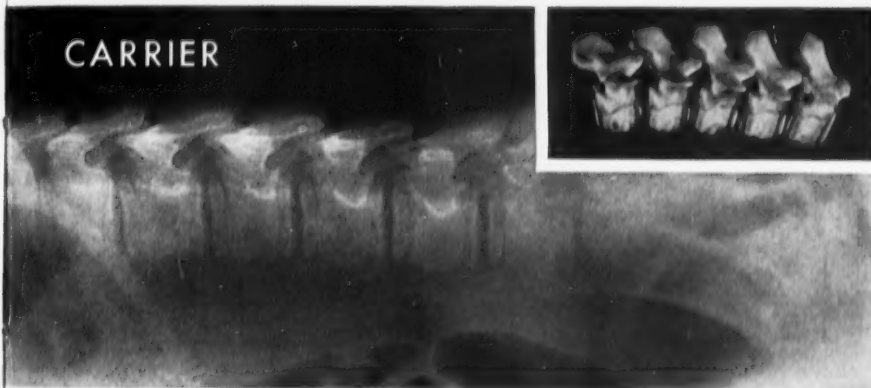
Theoretically, mating carriers to carriers produces one-fourth normal offspring, one-half carriers, one-fourth dwarfs. Mating carriers to noncarriers never produces dwarfs, but half the offspring are carriers, the rest normal. All experimental matings between snorter dwarfs have produced dwarfs.

Bulls siring only normal calves when bred to 12 to 16 known carrier cows are free of the dwarf gene in 97 to 99 percent of the cases. This is a costly, time-consuming way to find clean bulls. But it's done in some fine herds.

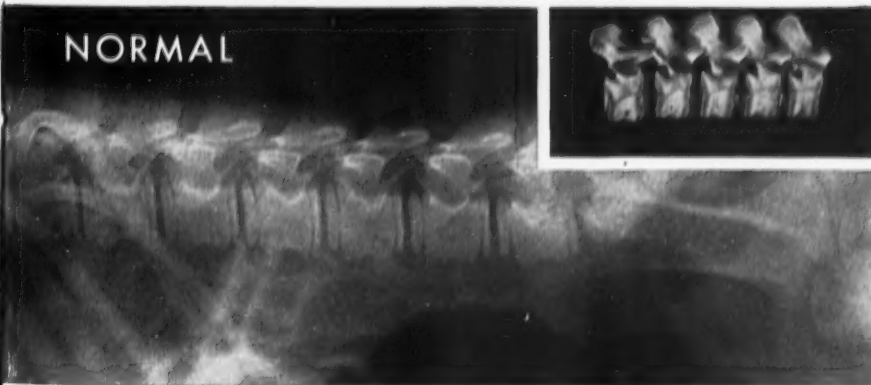
DWARF



CARRIER



NORMAL



X-RAYS HELP TELL ON DWARFISM

FROM PAGE 5



Another limitation of the X-ray technique is the difficulty in classifying X-rays showing borderline abnormalities. In addition, it's sometimes hard to get clear pictures, and equipment is expensive. Research is helping a great deal in obtaining better pictures.

Some breeders, veterinarians, and colleges are using X-rays on a trial basis. Most present equipment is satisfactory for use on calves.

Experienced, careful breeders can utilize this technique effectively for early screening of their calves. Breeding tests should be used as a further screen for animals with normal X-ray pictures if they have close relatives that produced dwarfs. Thus, it appears that the X-ray technique is likely to be a tool for herd improvement for individual breeders rather than a basis for merchandising cattle.

Several experimental techniques under investigation

The insulin-tolerance test, though still in the experimental stage, also offers promise for identifying carriers. It's thought that blood-cell counts of carriers differ characteristically from those of normal animals when both are given insulin. Accuracy and limitations of this test haven't been measured under a wide variety of conditions.

An experimental technique developed some years ago to find carriers in mature Hereford bulls by using a profilometer hasn't proved as accurate as expected. This instrument detects the slight forehead bulge thought to mark normal-looking animals as dwarf-gene carriers (AGR. RES., November 1953, p. 4). Although this method alone doesn't seem to positively identify carriers, it can provide valuable clues.

Easiest way to get rid of dwarfism would be to recognize carriers by their appearance. Head, body, legs, and tail size are all being studied to determine possible relationship to dwarfism. Spinal-fluid pressure and blood tests and various other approaches are being checked for any such relationship. Perhaps combinations of these methods—rather than any one alone—will tell us which animals are carriers.

Most small breeders can't afford the space and expense of maintaining a tester cow herd to get rid of dwarfism. For the time being, they can avoid or minimize it by carefully examining the blood lines of breeding stock they plan to buy for signs of dwarfism. The best bet is to buy cattle from breeders who are making special efforts to produce dwarf-free stock. Selection of dwarf-free pedigree lines isn't infallible. But it has the great advantage of being quick and inexpensive and is being used throughout the industry.

Losses from dwarfism probably average $\frac{1}{2}$ to 1 percent in our beef cattle—have run 10 to 12 percent or even higher in some herds. Such losses are important enough to deserve the attention of breeders who want to better their herds and make them more profitable.★

GOOD DIET FOR

Investigating nutrition of the
pests reveals facts needed
for variety of attacks

■ NUTRITIONAL NEEDS of destructive pests are under study by USDA and cooperating researchers. The information they obtain may aid plant breeders and entomologists in developing insect-resistant plant varieties. These studies might also lead to methods of feeding chemicals into plants to repel insects or to deprive them of an essential diet for normal development and reproduction.

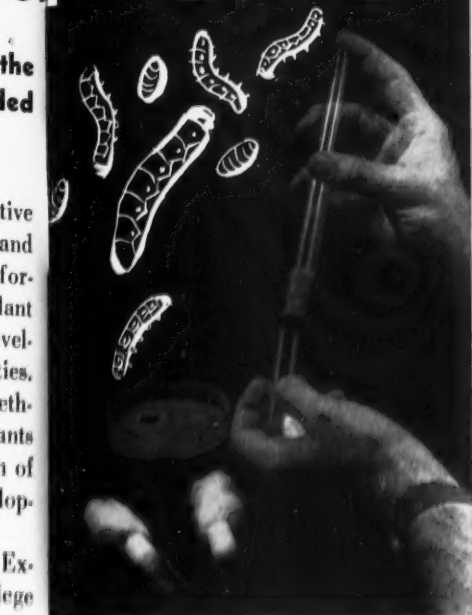
ARS and Texas Agricultural Experiment Station scientists, at College Station, have learned exactly what the nutritional requirements of the cotton-eating pink bollworm are.

Back in 1921, about 90 percent of the pink-bollworm eggs never produced adults in laboratory experiments. Now, the pink bollworm thrives in laboratory surroundings on a purified casein medium. This is the first recorded case of oligophagous insects (specialized eaters—in this case, insects attacking only plants belonging to the family Malvaceae) being reared under controlled conditions on chemically defined diets.

Pink bollworm fare varied

Variations are now being made in this medium's nutrient content in an attempt to produce large and more rapidly developing larvae. This would facilitate laboratory experiments to develop methods for controlling the insect. Omission of fat and choline prevented larval development. When cholesterol was omitted, larvae pupated but were abnormal. When sucrose content was reduced, or Wesson's-salt content increased, larval

insects



ARTIFICIAL MEDIUM is used to rear insects at European Corn Borer Research Laboratory, Ankeny, Iowa. Scientist fills vial with cooked, sterilized mixture.

NEWLY HATCHED larva is placed in vial, cotton stopper is added. Borers proceed through various stages without being disturbed for changing food.



THREE STAGES are studied in life development of the corn borer. First vial contains an immature larva. A mature larva is in second vial, and pupa of a European corn borer is growing in the third.

size was increased and growth and pupation rates were accelerated.

At USDA's Bozeman, Mont., entomology laboratory, researchers are trying to evaluate the nutritional requirements of grasshoppers by rearing the insects on a chemically defined diet. The data may help in development of measures to control the insect if environment can be manipulated later to cause metabolic upsets.

Hoppers use lettuce extract

Scientists have found that grasshopper growth proceeds to adulthood if a boiled water extract of leaf lettuce is added to a purified medium. Chemists are trying to characterize the compound or compounds involved.

Compounds extracted from corn are being evaluated cooperatively by ARS

and the Iowa Agricultural Experiment Station, at Ames. (Scientists believe some sweet corns have nutritive qualities that speed up maturing and emergence of corn earworms before they have done much damage. See AGR. RES., November 1956, p. 3.)

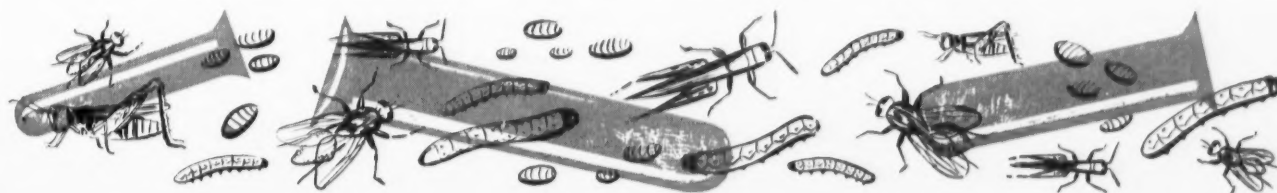
Reactions of the European corn borer to substances within the corn plant are under study, as well as the insect's behavior pattern during different life stages. The feeding medium is cooked, sterilized, and placed in vials with eggs or larvae. Vials are closed, enabling the borer to develop without being disturbed.

Entomologists who raise fruit insects for laboratory experiments believe rearing would be easier if more were known about nutrient requirements of the pests. This would apply

to the melon fly and the Mediterranean and oriental fruit flies in Hawaii, to the Mexican fruit fly in Mexico. Large numbers of each species are reared for testing the value of attractants and insecticides.

Proteins benefit fruit flies

When researchers studied the nutritional requirements of the adult Mediterranean fruit fly in Hawaii, they learned that certain hydrolyzed proteins are very valuable if not essential in the diet of the flies. When such materials were included in their diet, flies were much more vigorous, lived longer, and laid more eggs than in cases when such hydrolyzed proteins were absent from the diet. These insects also were somewhat harder to kill with insecticides.☆



Breeders, hatcherymen, flockowners participating in the plan gain by raising birds' efficiency, combating disease

NPIP is improving our Poultry

■ ENORMOUS STRIDES have been made the last 20 years in improving the efficiency of poultry production.

Combined results of better feeding, breeding, and management since 1935 have brought a spectacular rise in broiler raising as well as more efficient egg and meat production. In 1956 alone, we produced 1 billion 345 million broilers compared to only 34 million in 1934. Egg production per hen has increased by 45 percent during that period. And we can now grow 40 to 45 pounds of broiler meat on 100 pounds of feed.

Such improvements didn't just happen. Many branches of the industry contributed—including the National Poultry Improvement Plan.

NPIP is a joint Federal-State effort to (1) build up economical production of eggs and meat per bird, and (2) increase chick livability by getting rid of pullorum and typhoid.

Plan gives needed standards

The Plan had its start in the mid-thirties. At that time, expansion of the poultry industry was being checked by contagious diseases, especially pullorum disease, and lack of standards to measure the quality of hatching eggs and chicks sold under many different labels. Producers wanted specific, dependable, nationwide quality standards in breeding

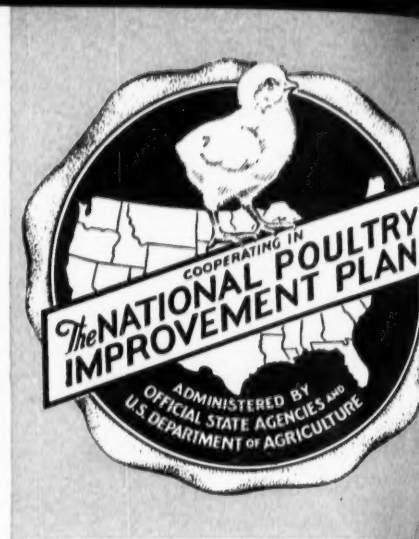
and disease control. To meet these needs, the Congress in 1935 passed legislation setting up the NPIP. There is also a similar National Turkey Improvement Plan (NTIP).

Birds' performance measured

One important method of measurement is the record of performance (ROP). This has been used to identify high-producing birds and families through trapnesting since NPIP began. Dissemination of stock by ROP breeders has contributed much to increased rate of egg production.

A newer way to measure performance in meat and egg production is the random-sample performance test. Samples of a breeder's commercial product—chicks or eggs of a designated grade or quality—are selected in a random (unbiased) way. All samples are raised under feeding and management conditions designed to reveal genetic differences. Performance data thus collected are useful in measuring differences in stocks. Results are being used as a basis for classifying flocks for the breeder, and chicks for his customers, under NPIP.

Improvements in efficiency can also be traced to another important fact. State inspectors are in constant touch with NPIP participants and quickly pass on to them new research information and recommendations.



Participation in the Plan is voluntary both for States and for poultry establishments within States. USDA, through Agricultural Research Service, acts as the national coordinating agency. An official State agency handles local administration.

Participation is open to all breeders, flockowners, and hatcherymen whose facilities and practices meet requirements of the national Plan and the official State agency.

What are the responsibilities of these breeders, flockowners, and hatcherymen? Each type of enterprise has several important concerns.

Records carefully maintained

Hatcherymen must keep accurate records to assure inspectors of their compliance with the Plan's provisions and to assure chick purchasers that the chicks are as represented. Their records must include, for instance, the name and address of each flockowner, number of eggs received from him, name and address of each purchaser, and number, breed, variety, and date of shipment of all chicks sold. Breeders and flockowners must also keep accurate records to assure the official State agency—as well as their customers—that they have met at least the minimum requirements for disease control. The participants' flocks are regularly tested and are

qualified only when no typhoid or pullorum reactors are found.

Breeding flocks are selected and tested under the supervision of State inspectors. Flocks and hatcheries are regularly inspected to insure compliance. Advertising is checked to prevent misleading statements.

Fees for participation vary from State to State—depending on State agency, size of flock or hatchery, number of birds tested, and so on.

Participants gain much from membership. Their products have the

confidence of purchasers, who know that the chicks, hatching eggs, or stock were produced in accordance with strict NPIP requirements. Only participants may use official labels, designs, and terminology of the Plan.

New developments reflected

Provisions of NPIP change from time to time to conform with new developments in the industry and new knowledge provided by research. Changes are based on recommendations made at the biennial plans con-

ference attended by delegates representing flockowners, breeders, and hatcherymen from cooperating States, and Federal and State Plan officials.

Membership in NPIP now includes 60 percent of the country's hatcheries with about 73 percent of the egg capacity. The Plan covers 39 million birds in 67,000 flocks.

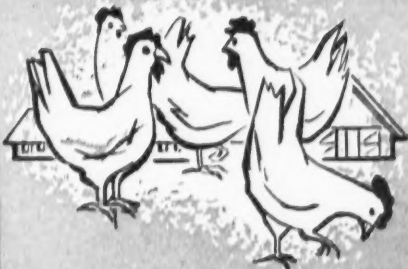
The poultry industry recognizes a need for even further improvement in production efficiency. NPIP provides one means for continuing and speeding up such progress.★

NPIP WORKS THROUGH...



BREEDERS

-produce superior stock by trap-nesting, progeny testing, strain crossing, hybridization, and so on



FLOCKOWNERS

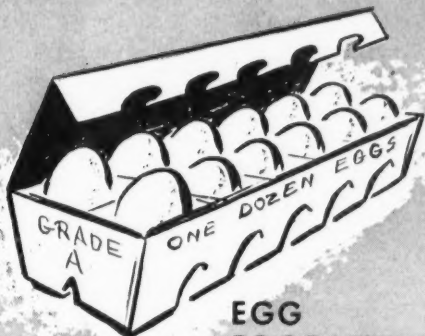
-maintain stock produced by breeders, for production of hatching eggs



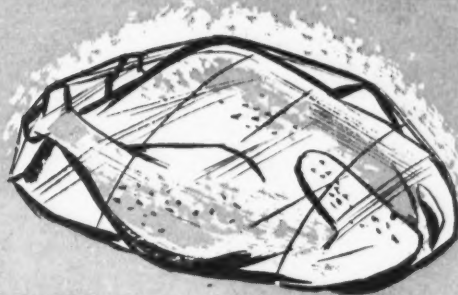
HATCHERYMEN

-hatch chicks from eggs produced by flock owners, for use by poultrymen

TO GIVE...



EGG PRODUCERS



BROILER GROWERS

More chicks that live

More eggs per hen, more meat in less time

WHAT HAPPENS IN FROZEN PORK?

Scientists are separating compounds related to rancidity, and revising measuring methods

■ ROAST PORK CAN be most appetizing. But if it's freezer stored too long without adequate protection from air, it can become rancid and have an unpleasant flavor and odor.

USDA scientists are finding out how and why this happens. So far, they have succeeded in separating several classes of chemical compounds that may cause the unpleasant flavor and odor. They are measuring the kind and amount of these compounds. A better understanding of the mechanism of oxidation of fats may help bring about better ways to stop it.

Rancidity is caused by chemical reaction of the fat with air (oxidation). Although lean meat isn't directly affected, it tastes rancid because fat permeates the lean tissue. Pork is especially susceptible and frequently becomes rancid after it has been freezer-stored for 7 or 8 months.

Rancidity is usually tested by taste panels for flavor and aroma. But this has serious drawbacks: it lacks precision, is difficult to standardize, and is time consuming.

Carbonyls, rancidity related

Among the compounds produced by decomposition of the peroxides (formed upon oxidation of fat with air) are the carbonyls. Our major hopes for a specific method to determine rancidity lie in separating, isolating, and measuring the pertinent carbonyl constituents. Carbonyls are thought to be responsible in some way because some have the characteristic sharp and disagreeable rancid odors.

Carbonyls can be divided into monocarbonyls and dicarbonyls according to the number of CO groups found in their molecules. ARS researchers are now concentrating on separating and isolating the monocarbonyls because they are thought to be more closely related to rancidity.

Meat technologist A. M. Gaddis heads the study, which has two objectives that go hand-in-hand—development of more specific methods of determining rancidity in stored pork, and separation, isolation, and identification of the carbonyl breakdown products. Assisting Gaddis are chemist Rex Ellis, and meat technician G. T. Currie, all of the Eastern Utili-

zation Research and Development Division, Philadelphia. Their work is being done at the Agricultural Research Center, Beltsville, Md.

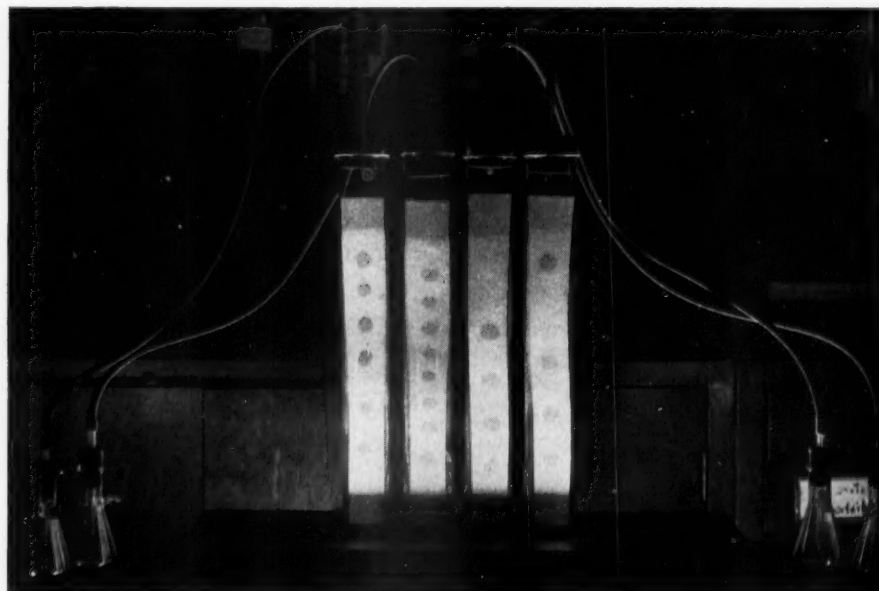
Gaddis and coworkers have already separated monocarbonyls into five classes. These differ in molecule size, placement of CO groups in their chemical makeup, and reactivity.

Here's how the chemical separation procedure used in the study works:

Pork compounds broken down

A sample of fatty tissue is separated from pork and ground. It's then warmed in a steam bath (mild rendering) and filtered, and the volatiles are vaporized with steam into a

SEPARATION of 14 known aldehydes by paper chromatography is shown in 2 control tubes at left; each spot is a different aldehyde. Tube third from left shows separation of sample into classes of aldehydes; position of spots identifies the class. Top spot (a saturated aldehyde) is separated in tube at right, checked for identification with controls.



complex organic chemical solution (2,4 dinitrophenylhydrazine). The distillate stands overnight to allow carbonyls to react with this chemical. Extraction of distillate with carbon tetrachloride and benzene takes out the resulting carbonyl derivatives. Column chromatography separates dicarbonyls—comprising up to 20 percent of total carbonyls present—and monocarbonyls—about 80 percent.

Chromatography process used

Paper chromatography is used to separate the monocarbonyls into two to five classes. Each of these is bright yellow in solution and turns up as an easy-to-read, bright-yellow spot on a treated paper strip. Each has characteristic absorption spectra and thus can be easily classified.

Classes of carbonyls increase in number and proportions change during oxidation. It's the relationship of these changes to taste tests and rancidity that Gaddis is studying. He has already shown that the two bottom spots (an enal and a dienal) on the treated paper strip aren't present in the early stages and increase as the oxidation progresses.

Paper chromatographic systems have been devised for separating individual members of each class. Constituents of the saturated aldehyde and ketone classes have been identified as formaldehyde, acetaldehyde, propionaldehyde, hexaldehyde, acetone, and methyl ethyl ketone.☆

SPOTS on treated paper strip are checked by Gaddis (left) to help identify compound. Currie (seated) fills tube with sample for further identification in photometer, Ellis prepares for preliminary separation.

FAT—Amount and Source

■ A LARGE SHARE OF THE FAT in our diets comes to the kitchen as part of foods not usually thought of as sources of fat. Meat, poultry, and fish provide 27 percent of this fat; milk, cream, cheese, ice cream, eggs, baked goods, and nuts supply 33 percent; the other 40 percent comes from common fats and oils including bacon and salt pork.

USDA food economists Eloise Cofer and Corinne LeBovit, in the ARS Institute of Home Economics, derived these figures by calculating the amount of fat in the foods that were reported in the 1955 Household Food Consumption Survey (AGR. RES., May 1957, p. 12).

The researchers found that families listed enough fats and fat-containing foods to provide about 155 grams (slightly over one-third pound) of pure fat per person per day. Probably not all this fat was eaten, but no information was obtained on the food discarded in preparation or as plate waste. This is a greater quantity of fat than was reported in the 1948 and 1936 surveys, the increase coming from greater quantities of meat, poultry, and fish in present-day diets.

The Northeast Region had the lowest average amount of fat (145 grams per person per day), the West the highest (163 grams). In each region, farm households had larger amounts of fat than nonfarm homes.

Regions differed in their food sources of fat. The Northeast got a greater proportion than other regions from meat (except pork), poultry, fish, milk, butter, and other milk products. The South got the lowest proportion from these foods; more of its fat came from pork and pork products and shortenings. The West got a higher proportion than other regions from oils, salad dressings, margarine, and eggs.

Much attention recently has been given to the composition of dietary fat because of possible relationships among various fatty acids, cholesterol, and health of the arteries. Many biochemists and nutritionists are trying to discover the effect on the body of saturated fatty acids (those with a full complement of hydrogen atoms) and of unsaturated fatty acids (in which the hydrogen potential is unsatisfied).

For this reason, the food economists estimated the amount of the saturated fatty acids and of two unsaturated fatty acids—linoleic and oleic—in the foods reported. Of the 155-gram national average total fat, 42 percent was saturated fatty acids. Unsaturated oleic acid made up 43 percent and linoleic 10 percent. Regions differed little in percentages of oleic and linoleic acids, although diets contained slightly more linoleic in the West than in other regions. The percentage of saturated fatty acids was slightly lower in the South.

More than half of the linoleic acid came from plant tissues and was found in such foods as salad oils, vegetable shortening, and margarine. Other foods yielded linoleic acid in much smaller amounts, pork and milk being next after plant foods. Oleic acid was found in a wide variety of foods in about the same proportion as total fat.☆



RUNOFF AND RAIN records for storms such as occur once or twice a century enable engineers to plan waterways and structures for farms, watersheds, and farming areas comprising a Florida district of 10 million acres. Runoff records for storm of October 13-15, 1956, on Indian River Farms watershed, is an example.

Florida's alternate floods and droughts are being dealt with by a research-based system of canals, reservoirs and pumps

■ BASIC INFORMATION from cooperative USDA-State research is helping to deal comprehensively with flood, drainage, and water supply in central and southern Florida. The experience is an example for similar areas.

The Central and Southern Florida Flood Control District, aided by a number of local, State, and Federal agencies, is now the focal point for many efforts. Such agencies had tried separately and locally—but unsuccessfully—over the years to solve the area's problem. The ARS Watershed Technology staff centered at Fort Lauderdale is developing hydrologic information in agricultural and potential agricultural areas specifically for District planners.

The stakes are too high for guesswork. It takes facts to plan a system involving hundreds of miles of major canals and feeder and farm ditches, a million acres of storage reservoirs, thousands of pumps collectively capable of moving millions of gallons of water per minute on peak demand.

Variety of facts required

The District must know how much water to reckon with, and when and where. It must know the extent of water shortage during the dry season—hence, where and how much water must be stored, when it is available, and how much must be drained to the sea. Planners need to know how fast the water must be moved in flood and



WEATHER, WATER data gathered regularly at representative sites through cooperative Federal-local research are basis for engineering tables and charts.

drought, what size ditches, canals, and pumps it takes for maximum flow, and the minimum flow and type of control structures required in seaward drainage canals to prevent salt water from intruding on the fresh water supply.

Needs and tolerances found

On behalf of agriculture, the program embraces flood prevention on farmland, development of swamp-land for farming through water control, and storage of enough water where needed for dry-season irrigation. Hydrologic studies made jointly by ARS, the Florida Agricultural Experiment Station, and the Flood Control District are now spelling out agriculture's requirements and tolerances for water. These and similar data applicable to other groups are being translated into specifications for canals, pumping stations, reservoirs, and their operation on behalf of good living on 10 million acres.

The Flood Control District staff is using three kinds of data developed by ARS hydraulic engineer J. C. Stephens and his associates under a cooperative agreement of the two agencies, financed in part by the District. This includes data on water requirements for growing the area's crops and maintaining the soil, on the maximum water tolerances of those crops, and on the behavior of water on agricultural and potential agricultural land. Water requirement includes not only what the crops use but also the surface evaporation from canals and reservoirs and the large consumption of water by water weeds.

In continuing its cooperation, the District shows the importance it attach to such technical assistance on problems involving the expenditure of millions of dollars of public funds.

For example, Stephens learned we need enough water to keep a 24-inch water table on 240,000 acres of potential agricultural peat soils in the Everglades to prevent excessive burn-

ing up of those soils (AGR. RES., October 1957, p. 3). A fall or spring crop of corn takes 12.3 inches of water for optimum yield, and most healthy crops can tolerate flooding up to 36 hours, but no longer (AGR. RES., November 1957, p. 12).

The ARS staff is building up records of inestimable value to the District engineers on the rainfall and runoff patterns of several watersheds of various sizes in the Indian Farms watershed (near Vero Beach) and Taylor Creek watershed 25 miles to the southwest. The latter is an undeveloped area with a different water behavior than agricultural land. The area is expected to develop agriculturally, so Stephens will follow the changes in hydrologic pattern closely. That will help the District make plans for areas due to be opened up for agriculture in the years ahead.

Engineers use the charts

Data were collected and curves plotted showing rainfall and runoff rates of these variously sized watersheds during 1956 storms of near-record intensity. The engineers are using these and other curves in estimating runoff conditions expected through the 10-million-acre District. That determines the size of canals, reservoirs, levees, pumps, gates, and other water controls required, and indirectly the clearance necessary for highway and railway bridges.

In general, the District will manage its facilities to have water as low as practical in the canals and soil throughout the rain and hurricane season, then as high as practical just before the irrigation season.

A century of trial and error didn't solve Florida's water problem, but today we're on our way. Research is making the difference. Facts being learned may be of help to other areas—may give them a good start on research they must do locally to develop their drenched lands. ☆



FARM

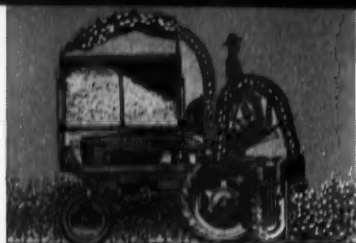


WATERSHED

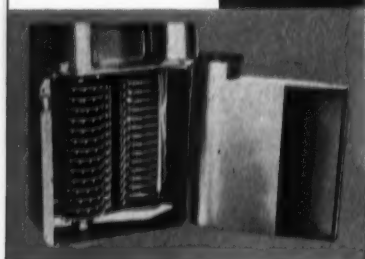
WATER NEEDS and tolerances must be met by right kind and size of structures for drainage, storage, and irrigation. For examples, note ditches and pumps at Ryburn Farm (top), main arterial canal that serves all farms in Indian River Farms watershed near Vero Beach (middle), and giant pumping station and obscured reservoir (below) serving entire Everglades area.



DRAINAGE DISTRICT



MECHANICAL picker is one modern influence on cotton quality. Cotton tends to clog in picker drum (left), but wetting the spindles (below) solves the problem without damaging the lint.



Effect of innovations varies, but study shows over-all effect on lint is good

Modernized Production and Cotton Quality

■ **HOW ARE THE FAR-REACHING innovations in cotton production affecting the cotton that farmers sell?**

Quality studies made at USDA ginning-research laboratories show that some of the developments simplify the drying, cleaning, and ginning operations or improve the lint, some have no effect, and others complicate ginning or adversely affect the lint. On the whole, the modern innovations studied should be beneficial to cotton.

Picking by machine presents difficulties

Mechanical picking, the most important innovation, did not in itself impair cotton grade in these ARS studies but did lead indirectly to its impairment. Under test con-

ditions at Stoneville, Miss., moisture-laden morning-picked cottons not taken promptly to the gin and dried lost about one grade, chiefly by fiber discoloration. Slower hand picking allows cotton to dry out within a short time.

There's another machine-picker problem—the tendency of cotton to adhere to picker spindles, necessitating use of water or other liquid to keep them clean. Liquids applied to the spindles cause the lint to doff (come off) and prevent buildup of plant juices and dirt on spindles. Tests conducted under West Coast picking conditions show that water with wetting agents added is one of the best solutions. But textile oil, another spindle moistener, reduces mechanical picker efficiency, especially when the oil is used at low rates of application.

Spindle moisteners don't impair the lint

These moistening agents had no significant effect on the cotton grades, its fiber, and the spinning and finishing properties of the lint, except that high rates of textile oil may tend to give slightly different dyeing qualities to cottons made into certain types of finished cloth.

In a study of stripper harvesting, plant population influenced the size of cotton plants and indirectly the quantity of trash gathered in the strippers. Under test conditions in Oklahoma, a population of about 50,000 plants per acre produced the largest gross returns to farmers, based on yield and quality. Populations were tested, ranging from 10,000 to 90,000 plants per acre in rows spaced at a distance of 40 inches apart.

Defoliant gets rid of leaves early, open plants to light and warmth, and cause more bolls to open so the machine can pick most of the crop in one trip through the field (AGR. RES., May 1954, p. 6). In the Stoneville studies, timing of defoliation and of harvest influenced lint grade. Cotton defoliated at the right maturity stage and then picked at the right time wasn't damaged. But cotton defoliated too early wasn't fully mature and had more neps than cotton that shed its leaves normally and matured properly. And the greater neppiness associated with immaturity impaired the appearance of the yarn.

Smooth-leaf strains have less trashiness

As expected, the experimental smooth-leaf strains of cotton, developed to counteract greater trashing-up in machine picking (AGR. RES., October 1954, p. 5), had less trash after cleaning and after ginning than standard cottons tested at Stoneville. There was little difference in trashiness among commercial varieties.

Irrigation improved most quality measurements—length, uniformity, maturity—without much effect on picker and card waste. Some qualities were improved more than others, especially in some varieties. ☆

New compound in beans

An important new chemical compound—gamma-glutamyl-S-methylcysteine—has been isolated from seeds of green and kidney beans by USDA scientists. It may play a key role in the germination of bean seeds and in the metabolism of plants because (1) the seeds contain high concentrations of the compound, and (2) the compound is closely related chemically to glutathione—an important plant metabolite. (Complete function of glutathione in plant metabolism, however, isn't fully understood.)

The new compound is a peptide, comprised of two amino acids linked



together—glutamic acid and S-methylcysteine. Researchers believe it may also be present in other beans.

The discovery was made by ARS chemists Robert M. Zacharius, of the Eastern Utilization Research and Development Division, Philadelphia, and Clayton J. Morris and John F. Thompson, of the U. S. Plant, Soil, and Animal Nutrition Laboratory, Ithaca, N. Y. Further work is underway to find the peptide's role in germination and plant metabolism, and effect on the quality of processed beans.

Seek blight-free chestnut

Large blight-free American chestnut trees were located in 36 States in 1957. USDA's Forest Service is checking resistance of these newly found trees by two methods:

Artificial inoculation of the native trees with the fungus is underway. And scionwood from trees suspected

of being resistant is grafted on small seedlings in areas where blight is present. Resistant trees will live, and others will die after sufficient exposure to the disease.

If resistant trees are found and their progeny prove resistant, they might provide American chestnuts for our forests again. Chestnut blight, caused by the fungus *Endothia parasitica*, was introduced into America from the Orient 50 years ago. Since then, all commercial stands of this hardwood have been destroyed.

Strongest possibility of disease resistance may be in some of the large trees that have remained free of the blight in areas where the disease is well established, scientists say. Such trees were long exposed to the blight.

The Forest Service would like to learn the location of additional large American chestnut trees. Individuals may propagate and test trees by grafting scionwood from them to other chestnut root stock. Detailed instructions on grafting can be obtained by writing to the Forest Service, USDA, Washington 25, D. C.

Cover crop and soil crumb

Winter cover crops are a big help in keeping soil loose and granular, just as crop residues and mulches do.

Repeated freezing and thawing may improve soil by breaking up clods, but under certain field conditions these forces frequently damage soil-aggregate structure (clustering of fine soil particles into "crumbs"). Soil-management specialists at USDA's Agricultural Research Center, Beltsville, Md., have found that cover crops planted early in the fall insulate the soil and reduce the amount of this damage. Rye and other cereals, ryegrass, annual bromegrass, vetch, and

crimson clover helped preserve desirable amounts of soil aggregation.

Soil samples taken in the spring from plots drilled to rye in 7-inch rows the preceding fall showed much less breakdown of soil aggregates than adjoining plots without ground cover. Before growth stopped, the rye was 5 inches high, covered half the ground, and gave the soil much protection.

Bonus from a systemic

Cattlemen using the systemic insecticide ET-57 to control grubs can expect a bonus: partial elimination of some species of roundworms.

This anthelmintic effect was revealed in USDA tests at the Regional Animal Disease Research Laboratory, Auburn, Ala. ARS parasitologists Harry Herlich and J. M. Johnson caution, however, that the new product is not a substitute for the standard worm preventive, phenothiazine.

In tests with eight grade Jersey steers, these researchers found that ET-57 equaled phenothiazine in removing an average of 98 percent of the stomach worm *Haemonchus placei*. And ET-57 got rid of 59 percent of the small-intestine worm *Cooperia punctata*—more than phenothiazine ordinarily removes. But results were erratic in the case of several other common species. Two (*Trichostrongylus colubriformis* and *Nematodirus helvetianus*) were completely unaffected by the compound.

There was no apparent difference in the effectiveness of a commercially prepared emulsion of ET-57 and a wettable powder formulation.

This chemical is being marketed for limited use against grubs in certain areas of Iowa, Nebraska, South Dakota, and Wyoming. Treatments must not be made later than 60 days

TESTS AGRISEARCH NOTES AGRISEARCH

before slaughter, and lactating cows should not be treated because of the threat of residues in the milk. The compound should be given after the adult-heel-fly season ends but before the grubs show up in animals' backs. One treatment—strictly according to directions—is enough.

ET-57 is administered orally as a large pill, or bolus, or as a liquid by use of a dose syringe. It circulates with the body fluids and destroys grubs that have burrowed into the flesh—first systemic proved capable of doing so.

Thimet for two more crops

Thimet, the systemic insecticide that is helping control cotton insects (AGR. RES., February 1957, p. 10), also looks promising for control of aphids on turnips, and spider mites and aphids on strawberries.

USDA preliminary tests at Whittier, Calif., indicated that green peach and bean aphids and two-spotted spider mites could be controlled for 2 months by application of Thimet sprays in furrows near strawberry plants. Foliage sprays proved just as good, according to ARS entomolo-



gists. Application of granular material in the furrow was less effective.

Turnip plants were infested with the turnip aphid and the green peach aphid. Granules applied prior to

seeding and soil applications and sprays made 2 months later were equally good. Only the furrow spray applied prior to seeding did not give adequate control. Turnip samples showed only a trace of Thimet, less than .004 part per million.

This systemic is being tested further on turnips and strawberries.

How to pick a man's suit

All men want lasting fit, comfort, and good appearance in a suit.

One can't tell by *examination alone* whether a new suit has these qualities. Much that affects wearability is hidden and certain values show up only with wear and cleaning.

A man can make a better choice of a new suit if he learns how the various fibers differ in their characteristics, what kinds of suitings are best for different kinds of wear, how suits of different grades are made, how materials and workmanship affect values, and how to judge fit of the suit.

Information on these points is given in USDA Home and Garden Bulletin 54, "Men's Suits: How To Judge Quality." Clothing specialist Clarice L. Scott, in the ARS Institute of Home Economics, gathered facts for this publication by visiting factories, tailor shops, and retail stores. She describes suit fibers and fabrics and characteristics of workmanship and construction materials used in suits of high, medium, and low grade. There's a checklist of points essential to good fit in a suit. She also ex-

plains the importance of reading labels and pocket stuffers.

Urgent nutrition research

The Food and Nutrition Research Advisory Committee, which advises USDA on its nutrition research, has recommended that USDA give high priority to extended studies on fats and their role in human nutrition.

More accurate methods for analyzing both vegetable oils and animal fats are needed to carry on basic research into kinds of fats essential for human diets and for establishing optimal conditions for processing commercial fat products. Another study would determine the fatty-acid requirements of human beings at various ages, the relationship of fat to



metabolism of other nutrients, desirable fat intake, and dietary precautions needed when diets are unusually high or low in different kinds of fat. Collection of additional data on fatty acids and other lipid fractions in foods is another undertaking the committee recommended as urgent.

High priority was also given to expanded work on pesticide residues, compiling analytical data on composition and nutritive value of foods, and developing methods for rapidly and accurately measuring quality in raw and processed food commodities.